

LISTS OF SPECIES

Mammals from Mato Grosso do Sul, Brazil.

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Abstract: The aim of this paper is to provide a checklist of flying and non-flying mammal species which occur in the state of Mato Grosso do Sul, delimiting species by vegetation domains and vulnerability. Records were based on specimens in museums, literature, and only eventually on photos (by camera traps). There are 151 mammal species reported or collected in the state, comprising 10 orders and 29 families. The richest orders were Chiroptera (61 spp.), Rodentia (35), Carnivora (18), and Didelphimorphia (16). The richest families were Phyllostomidae (33 species), Cricetidae (23), Didelphidae (16), Molossidae (13), Vespertilionidae (9), Felidae (7), and Dasypodidae (6). Cerrado was the richest domain (117 spp.) followed by Pantanal (110). According to the *Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis* (IBAMA) and the International Union for Conservation of Nature (IUCN), 17 species are threatened; they are species of Felidae (n = 6), but also include Canidae (2), Didelphidae (2), Cervidae (1), Dasypodidae (1), Dasycercidae (1), Mustelidae (1), Myrmecophagidae (1), Phyllostomidae (1), and Tapiridae (1).

Introduction

The Neotropical mammals comprise a vast number of species of different forms and habits, distributed in 11 orders (Emmons and Feer 1997). Marsupials, rodents, bats, and carnivores comprise more than 60 % of the Neotropical species, but little is known on their geographic distribution in many regions, particularly in South America (Redford and Eisenberg 1992; Eisenberg and Redford 1999). Brazil has one of the largest Neotropical mammal fauna (over 520 species), with a high number of endemism (n ≈ 131 endemic species) mainly found among primates and rodents (Fonseca et al. 1996; Ministério do Meio Ambiente 2000). The state of Mato Grosso do Sul is located in south-western Brazil, presenting 358,159 km² and two main vegetation-climatic domains, the Cerrado (savanna-like) and the Pantanal (wetlands) (Ab'Saber 1977) but also the Atlantic Forest domain in the south. The human population size in the state is low when compared to other states in eastern Brazil: only 2,075,000 citizens living in 78 municipalities or

in rural areas, leading to a low demographic density (Mato Grosso do Sul 2007). The state is still little known regarding to the mammal faunal composition, particularly on the small-sized species. Nonetheless, it is expected that mammal species richness in Mato Grosso do Sul is high because the environmental heterogeneity present there, as the different vegetation domains and transitions (Veloso et al. 1991; Vivo 1997).

Although comprising only 25 % of the state, the Pantanal is the domain that has attracted more attention of mammalogists in the last decades (Schaller 1983; Alho et al. 1987; Fischer 1997; Mauro and Campos 2000; Trolle 2003; Silveira et al. 2006), and the Cerrado which cover the majority of the Mato Grosso do Sul has received little attention. Examples of this are regions in the state which begin to be studied through mammal inventories, such as the Bodoquena Mountains (e.g. Carmignotto 2004; Cáceres et al. 2007b).

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Another neglected region is the Atlantic Forest domain at south of the state, severely stressed by agriculture and cattle ranching. The aim of this paper is to provide a checklist of mammal species which occur in Mato Grosso do Sul, delimiting them into domains and presenting their status regarding to vulnerability of extinction.

Materials and methods

Study site

The state of Mato Grosso do Sul (approximately, 17° to 24° S, 51° to 58° W) is located in the center-western region of Brazil, encompassing 4.2 % of the Brazilian territory. The climate is tropical in most of the state, but it tends to be subtropical in the south. It is markedly seasonal, with a wet and warm season from October to March and a dry and cold one from April to September. Annual rainfall is about 1,250 to 1,500 mm in the state, but decreasing slightly in the west, at the Pantanal. In the two vegetation-climatic domains, Cerrado and Pantanal, there are deciduous and semideciduous forests, and several transitional vegetation types which leaded some authors to consider the occurrence of Atlantic Forest and

Amazonian physiognomies in Mato Grosso do Sul (see IBGE 1992). Deciduous and semideciduous forests linked to the Atlantic Forest predominate in the south of the state and along the Paraná River, whereas deciduous forests linked to the Amazon occur in the Urucum and Amolar mountains in the northwest of the state. Influence of Chaco vegetation also occurs in the Urucum and Amolar due to proximity to Bolivia and Paraguay (Mares et al. 1985; Ab'Saber 1988; IBGE 1992). For this study, we consider three major physiognomies in the state: Cerrado, Pantanal, and Atlantic Forest at south of the main course of the Santa Maria and Brilhante rivers (near 21°50') and the transitional zone of Urucum and Amolar at right side of the Paraguay River (Figure 1).

Human population density is higher in the southeast Mato Grosso do Sul, where plantations are the main economic source, just where large extensions of seasonal Atlantic Forest existed in the past. Cattle ranching predominate in the rest of the state, except in the Urucum region.

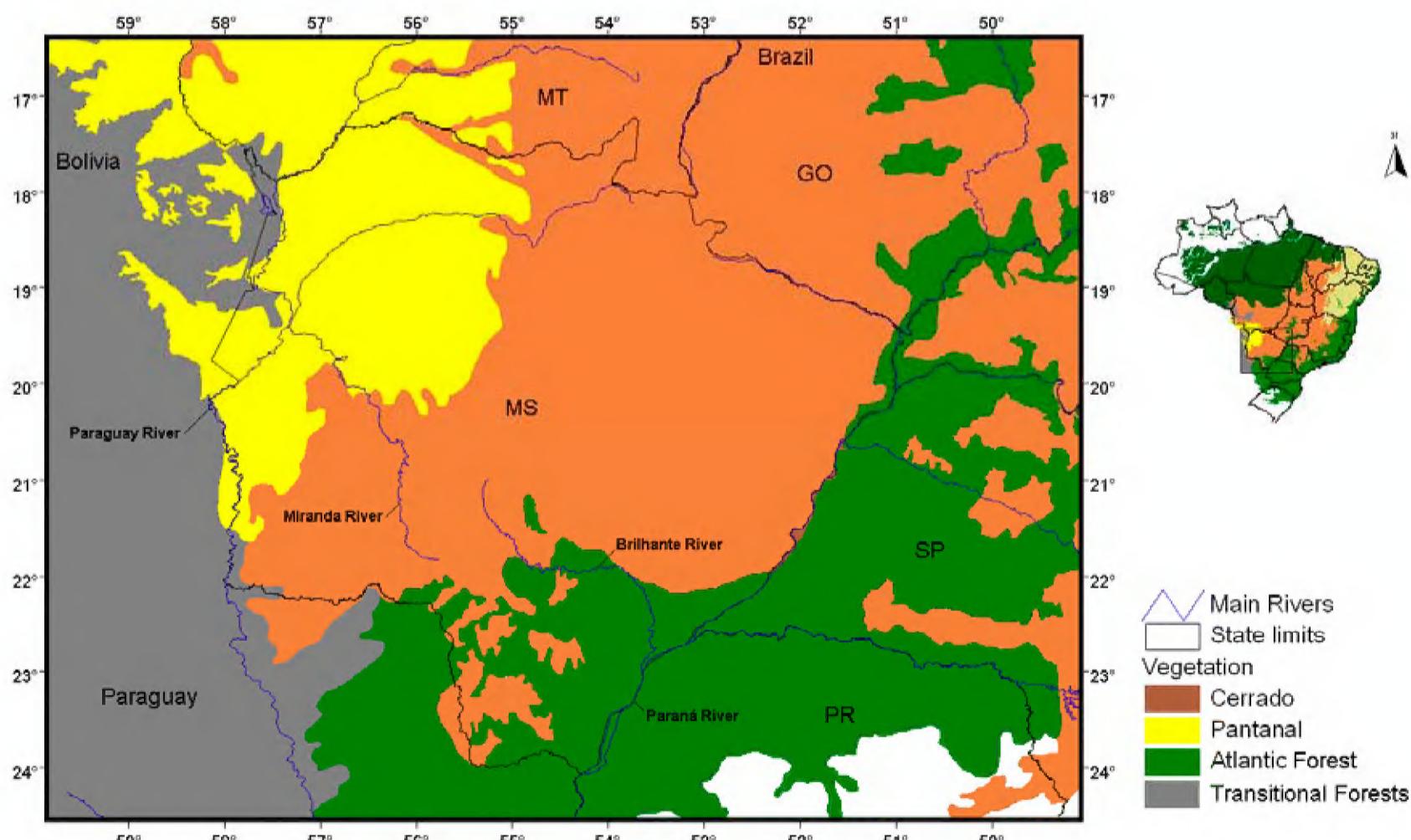


Figure 1. State of Mato Grosso do Sul (MS) showing the main rivers that cross the state and the vegetation domains according to IBGE (1992). This area is located in the south-western Brazil, as showed in the inserted map on the right side of the figure. Transitional forests correspond to a complex region that includes Amazon forest and Chaco influences.

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Data collection

Available records of mammal species were assessed primarily through analyses of specimens (skin and/or skull) in scientific museums and zoological collections in Brazil or elsewhere when specimens were deposited in collections in other countries. In addition, papers in which species were recognized by photography or eventual unpublished photographic records were also included. These procedures allow one to confirm species occurrences by checking specimens and photos. Photos were used only to confirm occurrence, and were proceeding from camera traps cited in publications, in order to become possible readers confirm the occurrence with respective authors. Publications placed after museum records are confirmatory or indicate species occurrence in different vegetation domains. The visited zoological collections were: American Museum of Natural History (AMNH), *Centro Universitário de Corumbá – Coleção de*

Mamíferos (CEUCM), Field Museum of Natural History (FMNH), *Museu de História Natural Capão da Imbuia* (MHNCI), *Museu Nacional* (MN), *Museu de Zoologia da Universidade de São Paulo* (MZUSP), Oklahoma Museum of Natural History (OMNH), *Universidade Estadual do Mato Grosso do Sul* (UEMS), *Universidade Federal de Minas Gerais* (UFMG), *Universidade Federal de Santa Catarina* (UFSC), *Universidade Federal de Santa Maria* (UFSM), National Museum of Natural History (USNM), and *Universidade Federal de Mato Grosso do Sul* (ZUFMS).

The nomenclature follows Wilson and Reeder (2005) and other recent systematic publications: Larsen et al. (2007) for *Artibeus planirostris*; Voss et al. (2004) for *Marmosops*; Voss et al. (2005) for *Cryptonanus*; Weksler et al. (2006) for different groups of "*Oryzomys*"; and Silva Júnior (2001) for *Cebus*.

Table 1. Mammals recorded in the state of Mato Grosso do Sul, south-western Brazil, according to zoological collections, literature, or photographic records. Domains: CE, Cerrado; MA, Atlantic Forest; PA, Pantanal; TR, Transitional zone between Chaco and Dry Amazon Forests. Zoological collections follow acronyms cited in the text (Data collection). Asterisks indicate threatened species according to IBAMA (2003). IUCN threaten category (EN, endangered and VU, vulnerable) was supplied when there was no threaten indication by IBAMA. When record was by photo, this is pointed out in the column "Sources".

Species	Domains	Sources
Didelphimorphia		
Didelphidae		
Caluromyinae		
<i>Caluromys lanatus</i>	CE	Carmignotto (2004); Cáceres et al. (2007b)
<i>Caluromys philander</i>	CE PA	UFSM 234; Carmignotto (2004)
Didelphinae		
<i>Chironectes minimus</i>	CE PA	UFSM 031; Silveira et al. (2006, by photo)
<i>Cryptonanus agricolai</i> ¹	CE MA	UFSM 089, 477
<i>Cryptonanus chacoensis</i>	TR	UFSM 267
<i>Didelphis albiventris</i>	CE MA PA TR	MN 4486; MZUSP 3779, 28753; UFMG 2558; UFSM 045; Napoli (2005); Silveira et al. (2006, by photo); Cáceres et al. (2007b)
<i>Didelphis aurita</i>	CE	AMNH 133036; Cerqueira and Lemos (2000)
<i>Gracilinanus agilis</i>	CE MA PA TR	MN 4465; MZUSP 1712, 11800; UFMG 2500; UFSM 086; USNM 390025; Costa (2003); Carmignotto (2004); Napoli (2005)
<i>Lutreolina crassicaudata</i>	CE MA PA	MN 20977; UFSM 326; Graipel et al. (1996); Silveira et al. (2006, by photo)
<i>Marmosa murina</i>	CE MA PA	MZUSP 1704, 28756; UFMG 2599; UFSM 536; Costa (2003)
<i>Marmosops ocellatus</i> ^{VU}	TR	MZUSP 32877; UFSM 213, 268; Cáceres et al. (2007d)
<i>Micoureus constantiae</i>	CE PA TR	UFSM 13, 263, 534; Vieira (1955); Carmignotto (2004); Cáceres et al. (2007b)
<i>Monodelphis domestica</i>	CE PA TR	AMNH 37098; MZUSP 1709, 3781, 17424; UFSM 010, 040; Vieira (1955); Carmignotto (2004); Napoli (2005); Cáceres et al. (2007b)
<i>Monodelphis kunsi</i> ^{EN}	CE TR	UFSM 167, 265; Carmignotto (2004); Napoli (2005)
<i>Philander opossum</i>	PA TR	AMNH 37063; MN 29949; MZUSP 8306; UFMG 2662; Vieira (1945)
<i>Thylamys macrurus</i>	CE PA	MZUSP 3782, 32097; UFSM 035; Carmignotto (2004); Rademaker et al. (2005); Cáceres et al. (2007b; c)

¹ We follow Voss et al. (2005) for the taxonomy of *Cryptonanus*, but since they analyzed few Brazilian specimens, the individuals from Mato Grosso do Sul could possibly refer to a different taxon, not yet described.

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Table 1. Continued.

Cingulata		
Dasypodidae		
Dasypodinae		
<i>Dasypus novemcinctus</i>	CE MA PA TR	MHNCI 5660; MZUSP 28768; Allen (1916); Schaller (1983); Alho et al. (1987); Trolle (2003, by photo); Silveira et al. (2006, by photo)
<i>Dasypus septemcinctus</i>	PA	Silveira et al. (2006, by photo)
Euphractinae		
<i>Euphractus sexcinctus</i>	CE MA PA TR	MHNCI 5663; MN 4972; MZUSP 28544; Allen 1916; Schaller (1983); Alho et al. (1987); Silveira et al. (2006, by photo)
Tolypeutinae		
<i>Cabassous unicinctus</i>	CE PA	MN 4975; Fischer (1997); Bordignon et al. (2006); Silveira et al. (2006, by photo); Mamede and Alho (2006)
<i>Priodontes maximus</i> *	CE PA TR	Allen (1916); Schaller (1983); Mamede and Alho (2006); Silveira et al. (2006; photo)
<i>Tolypeutes matacus</i>	CE PA TR	Schaller (1983); Alho et al. (1987); Vieira (1955); Mauro and Campos (2000); Lima Borges and Tomás (2004); Rodrigues (2004)
Pilosa		
Myrmecophagidae		
<i>Myrmecophaga tridactyla</i> *	CE PA	MHNCI 4048; MN 5073; MZUSP 7789; Schaller (1983); Alho et al. (1987); Mauro and Campos (2000); Trolle (2003, by photo)
<i>Tamandua tetradactyla</i>	CE MA PA TR	MN 5056; MZUSP 20000; UFSC 900; Schaller (1983); Trolle (2003); Cáceres et al. (2007b)
Chiroptera		
Emballonuridae		
Emballonurinae		
<i>Rhynchonycteris naso</i>	CE PA	ZUFMS (00052, 00053); Vieira (1942)
<i>Pteropteryx macrotis</i>	CE	Bordignon (2006)
Molossidae		
Molossinae		
<i>Cynomops brasiliensis</i>	PA	Leite et al. (1998); Fabián and Gregorin (2007)
<i>Cynomops planirostris</i>	CE PA	ZUFMS (00162); Leite et al. (1998); Bordignon and França (2004); Bordignon (2006); Fabián and Gregorin (2007)
<i>Eumops auripendulus</i>	CE PA	ZUFMS (00146); Marinho-Filho and Sazima (1998); Leite et al. (1999); Fabián and Gregorin (2007)
<i>Eumops bonariensis</i>	CE PA	Marinho-Filho and Sazima (1998); Bordignon (2006)
<i>Eumops glaucinus</i>	CE PA	ZUFMS (00145); Leite et al. (1998); Bordignon (2006); Fabián and Gregorin (2007)
<i>Eumops perotis</i>	CE PA	Marinho-Filho and Sazima (1998); Bordignon and França (2004)
<i>Molossops temminckii</i>	CE PA	ZUFMS (00147); Leite et al. (1998; 1999); Bordignon (2006)
<i>Molossus molossus</i>	CE PA	ZUFMS (00010, 00028); Leite et al. (1998; 1999); Bordignon (2006); Fabián and Gregorin (2007)
<i>Molossus rufus</i>	CE PA	ZUFMS (00009, 00011); Leite et al. (1998); Bordignon (2006); Fabián and Gregorin (2007)
<i>Nyctinomops laticaudatus</i>	CE PA	ZUFMS (00012, 00018, 00149); Leite et al. (1998); Fabián and Gregorin (2007)
<i>Nyctinomops macrotis</i>	CE PA	ZUFMS (00148); Leite et al. (1998); Marinho-Filho and Sazima (1998); Fabián and Gregorin (2007)
<i>Promops nasutus</i>	PA	ZUFMS (00039)
<i>Promops centralis</i>	PA	ZUFMS (00021)
Mormoopidae		
<i>Pteronotus parnellii</i>	PA	Marinho-Filho and Sazima (1998); Bordignon (2006); Zanon and Reis (2007)
Natalidae		
<i>Natalus stramineus</i>	CE	ZUFMS (00144); Taddei and Uieda (2001); Bordignon (2006)
Noctilionidae		
<i>Noctilio albiventris</i>	CE PA	ZUFMS (00055, 00058); Leite et al. (1998); Gonçalves et al. (2007)
<i>Noctilio leporinus</i>	CE PA	ZUFMS (00143); Leite et al. (1998)

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Table 1. Continued.

Phyllostomidae		
Carollinae		
<i>Carollia perspicillata</i>	CE PA	ZUFMS (00100, 00105); Leite et al. (1998; 1999); Bordignon and França (2004); Bordignon (2006); Graciolli et al. (2006); Cáceres et al. (2007b)
Desmodontinae		
<i>Desmodus rotundus</i>	CE PA	ZUFMS (00121; 00115); Leite et al. (1998); Bordignon and França (2004); Bordignon (2006); Cáceres et al. (2007b)
<i>Diaeus youngi</i>	PA	ZUFMS (00078; 00164; 00165); Leite et al. (1998); Peracchi et al. (2006)
Glossophaginae		
<i>Anoura caudifer</i>	CE PA	ZUFMS (00042, 00073, 00150); Leite et al. (1998; 1999); Peracchi et al. (2006); Nogueira et al. (2007a)
<i>Anoura geoffroyi</i>	CE PA	ZUFMS (00151); Leite et al. (1998); Peracchi et al. (2006); Nogueira et al. (2007a)
<i>Glossophaga soricina</i>	CE PA	ZUFMS (00095, 00097); Leite et al. (1998; 1999); Bordignon and França (2004); Bordignon (2006); Cáceres et al. (2007b)
<i>Lionycteris spurreli</i>	CE	Bordignon (2006); Nogueira et al. (2007a)
<i>Lonchophylla mordax</i>	CE	Bordignon (2006); Nogueira et al. (2007a)
Phyllostominae		
<i>Chrotopterus auritus</i>	CE PA	ZUFMS (00109); Bordignon and França (2004); Bordignon (2006); Peracchi et al. (2006); Nogueira et al. (2007b)
<i>Lonchorhina aurita</i>	CE PA	Marinho-Filho & Sazima (1998); Bordignon (2006); Nogueira et al. (2007b)
<i>Lophostoma brasiliense</i>	CE PA	ZUFMS (00113); Bordignon (2006); Nogueira et al. (2007b)
<i>Lophostoma silvicolum</i>	CE PA	ZUFMS (00110); Leite et al. (1998); Bordignon (2006); Nogueira et al. (2007b)
<i>Macrophyllum macrophyllum</i>	CE PA	ZUFMS (00152); Marinho-Filho and Sazima (1998)
<i>Micronycteris megalotis</i>	CE	ZUFMS (00153); Bordignon and França (2004)
<i>Micronycteris minuta</i>	CE PA	Leite et al. (1998); Simmons et al. (2002); Nogueira et al. (2007b)
<i>Micronycteris schmidtorum</i>	CE	ZUFMS (00161)
<i>Mimon crenulatum</i>	PA	ZUFMS (00108); Camargo and Fischer (2004)
<i>Phylloderma stenops</i>	PA	Leite et al. (1998); Nogueira et al. (2007b)
<i>Phyllostomus discolor</i>	CE PA	ZUFMS (00154, 00155); Leite et al. (1998; 1999); Nogueira et al. (2007b)
<i>Phyllostomus hastatus</i>	CE PA	ZUFMS (00106, 00156); Leite et al. (1998); Bordignon (2006); Nogueira et al. (2007b)
<i>Tonatia bidens</i>	PA	Marinho-Filho & Sazima (1998); Nogueira et al. (2007b)
Stenodermatinae		
<i>Artibeus fimbriatus</i>	CE	UFSM 541
<i>Artibeus lituratus</i>	CE PA	ZUFMS (00166); Leite et al. (1998); Marinho-Filho and Sazima (1998); Bordignon (2006); Cáceres et al. (2007b)
<i>Artibeus planirostris</i> ²	CE MA PA	ZUFMS (00001, 00002, 00037, 00163); Leite et al. (1998; 1999); Bordignon (2006); Graciolli et al. (2006); Cáceres et al. (2007b)
<i>Chiroderma villosum</i>	PA	ZUFMS (00158, 00159); Leite et al. (1998); Marinho-Filho and Sazima (1998)
<i>Chiroderma doriae</i> ^{VU}	CE PA	ZUFMS (00157); Gregorin (1998); Bordignon (2005)
<i>Platyrrhinus helleri</i>	CE PA	ZUFMS (00133, 00158); Marinho-Filho and Sazima (1998); Bordignon (2006)
<i>Platyrrhinus lineatus</i>	CE PA	ZUFMS (00005, 00022); Leite et al. (1998; 1999); Marinho-Filho and Sazima (1998); Bordignon (2006); Graciolli et al. (2006); Cáceres et al. (2007b)
<i>Pygoderma bilabiatum</i>	CE PA	ZUFMS (00128); Marinho-Filho and Sazima (1998)
<i>Sturnira lilium</i>	CE MA PA	ZUFMS (00130, 00131); Leite et al. (1998; 1999); Marinho-Filho and Sazima (1998); Bordignon (2006); Graciolli et al. (2006); Cáceres et al. (2007b)
<i>Uroderma bilobatum</i>	CE PA	ZUFMS (00132); Marinho-Filho and Sazima (1998)
<i>Vampyressa pusilla</i>	CE PA	ZUFMS (00159); Bordignon (2006); Longo et al. (2007)
<i>Vampyrodes caraccioli</i>	PA	ZUFMS (00129)
Vespertilionidae		
Myotinae		
<i>Myotis simus</i>	PA	ZUFMS (00006); Leite et al. (1998); Vicente and Jim (2005); Bianconi and Pedro (2007)
<i>Myotis albescens</i>	CE PA	ZUFMS (00141, 00142); Leite et al. (1998; 1999); Marinho-Filho and Sazima (1998); Vicente and Jim (2005); Bianconi and Pedro (2007)
<i>Myotis riparius</i>	CE PA	ZUFMS (00140); Marinho-Filho and Sazima (1998); Vicente and Jim (2005);
<i>Myotis nigricans</i>	CE PA	ZUFMS (00020, 00024, 00136, 00137); Leite et al. (1998; 1999); Marinho-Filho and Sazima (1998); Vicente and Jim (2005); Bordignon (2006); Bianconi and Pedro (2007)

² Previously considered as *Artibeus jamaicensis* (Larsen et al. 2007).

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Vespertilioninae		
<i>Eptesicus brasiliensis</i>	CE MA PA	UFSM 390; Marinho-Filho and Sazima (1998); Graciolli et al. (2006); Bianconi and Pedro (2007)
<i>Eptesicus furinalis</i>	CE PA	Leite et al. (1998; 1999); Marinho-Filho and Sazima (1998); Bianconi and Pedro (2007)
<i>Lasiurus blossevillii</i>	CE	ZUFMS (00134, 00135); Leite et al. (1999); Marinho-Filho and Sazima (1998)
<i>Lasiurus cinereus</i>	CE PA	Marinho-Filho and Sazima (1998); Leite et al. (1999); Bianconi and Pedro (2007)
<i>Lasiurus ega</i>	PA	ZUFMS (00138, 00139); Leite et al. (1998); Marinho-Filho and Sazima (1998); Bordignon (2006); Bianconi and Pedro (2007)
Primates		
Cebidae		
Callitrichinae		
<i>Callithrix melanura</i>	TR	MN 3370; MZUSP 3370; Allen (1916); Schaller (1983)
Cebinae		
<i>Cebus cay</i> ³	CE MA PA	MZUSP 19680; Allen (1916); Schaller (1983); Cáceres et al. (2007b)
Aotidae		
<i>Aotus azarae</i>	TR	MN 9608; MZUSP 9608; Schaller (1983); Mauro and Campos (2000)
Pitheciidae		
Callicebinae		
<i>Callicebus pallescens</i>	TR	MZUSP 3356, 3358; Schaller (1983); Mauro and Campos (2000)
Atelidae		
Alouattinae		
<i>Alouatta caraya</i>	CE MA PA TR	MN 4794, 4813, 19176; MZUSP 3769; Allen (1916); Vieira (1955); Schaller (1983)
Carnivora		
Canidae		
<i>Cerdocyon thous</i>	CE MA PA TR	MN 4908, 25602; MZUSP 3372; UFSM 330; Vieira (1955); Schaller (1983); Trolle (2003, by photo); Cáceres et al. (2007b)
<i>Chrysocyon brachyurus</i> *	CE PA TR	UFSM 081; Allen (1916); Schaller (1983); Fischer (1997); Mamede and Alho (2006); Silveira et al. (2006, by photo)
<i>Lycalopex vetulus</i>	CE MA	MN 4869, 5151; Cáceres et al. (2007b)
<i>Speothos venaticus</i> *	PA	Alho et al. (1987); Fischer (1997); Lima Borges and Tomás (2004, by photo)
Felidae		
Felinae		
<i>Leopardus braccatus</i> *	CE MA PA	MN 24904; MZUSP 7786; Vieira (1955); Bordignon et al. (2006, by photo); Mamede and Alho (2006); Cáceres et al. (2007b)
<i>Leopardus pardalis</i> *	CE MA PA TR	MN 68885; MZUSP 13673; UFSC 346; UFSM 413; Allen (1916); Schaller (1983); Fischer (1997); Trolle (2003, by photo); Cáceres et al. (2007b)
<i>Leopardus tigrinus</i> *	MA PA	UEMS mammal collection – Mundo Novo; Trolle (2003, by photo)
<i>Leopardus wiedii</i> * ⁴	TR	Allen (1916); Silveira et al. (2006, by photo)
<i>Puma concolor</i> *	CE MA PA TR	MZUSP 28868; UFSC 322; Allen (1916); Schaller (1983); Trolle (2003, by photo); Silveira et al. (2006, by photo); Cáceres et al. (2007b)
<i>Puma yagouaroundi</i>	CE PA TR	UFSM 331; Allen (1916); Schaller (1983); Fischer (1997); Silveira et al. (2006, by photo)
Pantherinae		
<i>Panthera onca</i> *	CE MA PA TR	MHNCI 4384; MN 24859; MZUSP 9018; UFSC 3105; Allen (1916); Trolle (2003, by photo); Sana and Crawshaw-Jr (2000); Mamede and Alho (2006)
Mustelidae		
Lutrinae		
<i>Lontra longicaudis</i>	CE MA PA	MN 3020; Schaller (1983); Fischer (1997); Silveira et al. (2006); Nilton C. Cáceres and Dirceu R. Freitas (photographic records)
<i>Pteronura brasiliensis</i> *	PA	MN 67470; MZUSP 5890; Mamede and Alho (2006)

³ This name is not considered by Groves (2005), but is based on "Le cay" Azara, 1809; *paraguayanus* Fischer, 1829, *azarae* Rengger, 1830, *chacoensis* Pusch, 1941, and *morrulus* Pusch, 1941 are considered synonyms (see Silva Júnior 2001); furthermore, Silva Júnior considered this taxon distinct from *C. libidinosus* Spix, 1823.

⁴ Wosencraft (2005) considered *wiedi* (J. A. Allen, 1916) a synonym of *Leopardus tigrinus* (Schreiber, 1775), but Pocock (1941) considered the specimen from Urucum a synonym of *L. wiedii* (Schinz, 1821). We follow Pocock's opinion.

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Mustelinae		
<i>Conepatus semistriatus</i>	PA	Lima Borges and Tomás (2004, by photo) (Silveira et al. 2006, by photo)
<i>Eira barbara</i>	CE MA PA TR	MN 3110, 5163; MZUSP 3375; Allen (1916); Schaller (1983); Fischer (1997); Silveira et al. (2006, by photo)
<i>Galictis cuja</i>	CE	Allen (1916); Fischer (1997)
Procyonidae		
<i>Nasua nasua</i>	CE MA PA TR	MHNCI 2551; MN 4895; MZUSP 3366; Allen (1916); Alho et al. (1987); Mamede and Alho (2006)
<i>Procyon cancrivorus</i>	CE PA	Trolle (2003, by photo); Silveira et al. (2006, by photo)
Perissodactyla		
Tapiridae		
<i>Tapirus terrestris</i> ^{VU}	CE MA PA TR	MZUSP 3727; Schaller (1983); Trolle (2003, by photo); Cáceres et al. (2007b; 2008)
Artiodactyla		
Tayassuidae		
<i>Pecari tajacu</i>	CE PA TR	MN 3826; MZUSP 3342; Allen (1916); Schaller (1983); Trolle (2003, by photo); Silveira et al. (2006, by photo)
<i>Tayassu pecari</i>	CE PA TR	UFSM 334; Schaller (1983); Trolle (2003, by photo)
Cervidae		
Capreolinae		
<i>Blastocerus dichotomus</i> *	CE MA PA TR	MHNCI 4037, 4077; MZUSP 28867; Schaller (1983); Mourão et al. (2000); Trolle (2003, by photo); Silveira et al. (2006, by photo); Nilton C. Cáceres (photographic record)
<i>Mazama americana</i>	CE PA TR	MZUSP 3735; Allen 1916; Schaller 1983; Trolle (2003, by photo); Silveira et al. (2006, by photo)
<i>Mazama gouazoubira</i>	CE PA TR	MZUSP 3785; Schaller (1983); Trolle (2003, by photo); Silveira et al. (2006, by photo)
<i>Ozotoceros bezoarticus</i>	CE PA TR	MZUSP 01920; Schaller (1983); Mourão et al. (2000); Bordignon et al. (2006, by photo)
Rodentia		
Sciuridae		
Sciurinae		
<i>Urosciurus spadiceus</i>	TR	MN 1923; MZUSP 3352; Allen (1916); Schaller (1983)
Cricetidae		
Sigmodontinae		
<i>Akodon montensis</i> ⁵	CE MA	UFMG 2682; Carmignotto (2004); Cáceres et al. (2007b)
<i>Akodon toba</i>	TR	UFSM 269; USNM 390251; Myers (1989)
<i>Calomys aff. callidus</i>	CE	UFSM 109 (see Pessoa et al. 2002)
<i>Calomys callosus</i> ⁶	CE	Carmignotto (2004)
<i>Calomys tener</i>	CE	MN 61582; MZUSP 21210; UFSM 060
<i>Cerradomys maracajuensis</i>	CE MA	MN 44178; MZUSP 28766; UFSM 088
<i>Cerradomys scotti</i>	CE PA	MN 4414; OMNH 19655; UFSM 025; 360; Carmignotto (2004)
<i>Euryoryzomys nitidus</i>	TR	FMNH 26786; UFSM 260, 261; USNM 390110; Musser et al. (1998)
<i>Holochilus chacarius</i>	TR	Oliveira and Bonvicino (2006)
<i>Holochilus sciureus</i>	PA TR	AMNH 37077; MN 1987; MZUSP 3780, 27430; UFSM 266; USNM 390249
<i>Hylaeamys megacephalus</i>	CE MA PA	MZUSP 4303; UFMG 2909; UFSM 011, 016, 033, 061; Costa (2003); Carmignotto (2004); Cáceres et al. (2007b)
<i>Necromys lasiurus</i> ⁷	CE MA PA TR	AMNH 37104; FMNH 26640; MZUSP 1701, 4301; OMNH 19132; UFSM 022, 170, 264; Macêdo and Mares (1986); Carmignotto (2004); Napoli (2005)

⁵ These specimens are identified as *A. montensis* based on karyotypic data ($2n = 24-26$). Since the *Akodon* species from the "cursor group" are very similar morphologically, and there are no karyotypic data available for the other specimens analyzed from Mato Grosso do Sul (AMNH, MN), it is possible that another species of *Akodon* occurs in the state, other than *A. montensis* and *A. toba*.

⁶ These specimens are identified as *C. callosus* based on karyotypic data ($2n = 50$, FN = 66). Since the *Calomys* species from the "large-size group" are very similar morphologically, and there are no karyotypic data available for the other specimens analyzed from Mato Grosso do Sul (FMNH, MZUSP, UFMG), it is possible that another species of *Calomys* occurs in the state, such as *C. expulsus* ($2n = 66$, FN = 68).

⁷ Anderson and Olds (1989) considered the status of *tapirapoanus* J. A. Allen, 1916 (type locality Tapirapoã, Rio Sepotuba) as a subspecies of *N. lenguarum*. Since Macêdo and Mares (1987) did not observe any significant difference between populations assigned to *tapirapoanus* and *lasiurus* Lund, 1841 in Brazil, they considered *tapirapoanus* a junior synonym of *lasiurus*. Here we follow their opinion.

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Table 1. Continued.

Sigmodontinae (continued)		
<i>Nectomys ratus</i> ⁸	CE	MN 46876; MZUSP 6010; UFSM 133; Bonvicino et al. (1996)
<i>Nectomys squamipes</i>	CE MA	MZUSP 28858; UFSM 044
<i>Oecomys bicolor</i>	CE MA PA TR	FMNH 26806; MN 2520, 34200; UFMG 2817, 2825; UFSM 054, 246, 273; Rademaker et al. (2005)
<i>Oecomys catherinae</i>	MA	MZUSP 28767; Carmignotto (2004)
<i>Oecomys mamorae</i>	CE PA TR	CEUCM 211; FMNH 26811; MZUSP 2270; UFMG 2827; UFSM 511; USNM 531278; Carmignotto (2004)
<i>Oecomys paricola</i>	TR	CEUCM 198
<i>Oligoryzomys chacoensis</i>	CE TR	FMNH 26641; UFSM 168, 271; USNM 390125; Myers and Carleton (1981); Carmignotto (2004)
<i>Oligoryzomys fornesi</i>	CE MA PA TR	OMNH 19657; UFSM 020, 242, 272, 367, 378; Carmignotto (2004)
<i>Oligoryzomys nigripes</i>	CE MA TR	MN 5219; MZUSP 25869; UFMG 2760; UFSM 001, 021, 278, 486; Carmignotto (2004); Cáceres et al. (2007b)
<i>Pseudoryzomys simplex</i>	CE	Rodrigues (2004)
<i>Rhipidomys macrurus</i> ⁹	CE MA	UFMG 2945; UFSM 032, 156; Tribe (1996); Napoli (2005)
Erethizontidae		
Erethizontinae		
<i>Coendou prehensilis</i>	PA TR	MN 3635; MZUSP 1859; Schaller (1983); Mamede and Alho (2006)
Caviidae		
Caviinae		
<i>Cavia aperea</i>	CE PA	FMNH 26638; MN 4476; MZUSP 4292
<i>Cavia fulgida</i>	MA	MZUSP 28757; Carmignotto (2004)
Hydrochoerinae		
<i>Hydrochoerus hydrochaeris</i>	CE MA PA TR	MHNCI 5658; MZUSP 25358; Schaller (1983); Silveira et al. (2006, by photo)
Dasyproctidae		
<i>Dasyprocta azarae</i> ^{VU} ¹⁰	CE PA	MN 4968; MZUSP 5896; Trolle (2003, by photo); Cáceres et al. (2007b)
Cuniculidae		
<i>Cuniculus paca</i>	CE PA	MN 4871; Silveira et al. (2006, by photo); Cáceres et al. (2007b)
Echimyidae		
Eumysopinae		
<i>Clyomys laticeps</i>	CE PA	MN 24156, 63945; UFMG 2346; Ávila-Pires and Wutke (1981)
<i>Proechimys gr. goeldii</i> ¹¹	TR	FMNH 26732; Carmignotto (2004)
<i>Proechimys longicaudatus</i>	CE TR	AMNH 37085; UFSM 034, 259; Vieira (1945); Patton (1987)
<i>Proechimys roberti</i>	CE	UFSM 282
<i>Thrichomys pachyurus</i>	CE PA TR	MN 6228; MZUSP 7499, 26731; UFMG 3008; UFSM 015, 161; Trolle (2003, by photo); Napoli (2005)
Lagomorpha		
Leporidae		
<i>Sylvilagus brasiliensis</i>	CE MA PA TR	MN 4774; UFSM 498; Vieira (1955); Schaller (1983); Silveira et al. (2006, by photo); Cáceres et al. (2007b; 2008)

⁸ These specimens were allocated to *N. ratus* based on karyotypic data ($2n = 52-55$).

⁹ In addition to *R. macrurus*, Tribe (1996) allocated the specimens from Maracaju, state of Mato Grosso do Sul (AMNH) to *Rhipidomys* sp.2. This taxon, not yet described, occurs "in the forested parts of the Serra de Maracaju and the Sierra de Amambay along the Brazil-Paraguay border" (Tribe 1996).

¹⁰ In addition to *D. azarae*, Iack-Ximenes (1999) allocated the specimens from Fazenda Acurizal and Corumbá, state of Mato Grosso do Sul (MN 2317) to *Dasyprocta* sp.1. This taxon has not been described yet.

¹¹ These specimens were allocated to the "goeldii group" *sensu* Patton (1987). They do not fit the description of any species already included in this group and since there is no revision of the names available for the Brazilian populations, we decided not to classify these specimens at species level.

Results and discussion

Mato Grosso do Sul has 151 mammal species being 90 terrestrial non-flying and 61 flying species, distributed in 10 orders and 29 families (Table 1). Other species might be added to this

fauna with more field collections or systematic studies, particularly bats, rodents, and marsupials. We analyzed several specimens housed in scientific collections, being the major source of the checklist.

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For large-sized mammal species, there is little material from Mato Grosso do Sul deposited in museums, the majority of data is based on aerial, track, and visual surveys, which do not consist of testimony material. One way to consider the information based on camera traps, visual and track surveys as testimony material is to make them available in a public or online data base or collection, where anyone could analyze and check the taxonomic identity of these material.

It surprised us that some species that are commonly recorded with camera traps or by indirect evidence such as tracks were rarely found in the museums, such as the Giant armadillo *Priodontes maximus*, the Armadillo *Tolypeutes matacus*, and the carnivores *Leopardus wiedii* and *Galictis cuja*, with only one record each, from the beginning of the twentieth century. Nowadays it is not common to collect the medium and large size mammal species. However, a great source of data, such as the animals found dead especially along the railroads, is discarded. The majority of them is encountered in good condition and could constitute very important testimony material, together with the locality data.

The total richness found here is slightly lower than that reported to other states in Brazil, such as Santa Catarina where 112 non-flying species were listed (Cherem et al. 2004) and Bahia where long-term and large inventories reported 78 bat species (Faria et al. 2006). Richness in the state of Paraná was estimated in 176 species, including flying and marine species (Margarido and Braga 2004). These states have the advantage of being located near traditional research centers in Brazil, which facilitate inventories (Cáceres et al. 2007a), and are in coastal regions where biodiversity is expected to be very high, in the Atlantic Forest domain (Veloso et al. 1991; Silva et al. 2004).

The main orders concerning species richness were Chiroptera (61 spp.), Rodentia (35), Carnivora (18), and Didelphimorphia (16). The more important families were Phyllostomidae (33 spp.), Cricetidae (24), Didelphidae (16), Molossidae (13), and Vespertilionidae (9). Species threatened according IBAMA (2003) and IUCN (2007) were 17, mainly in Felidae (6), Canidae (2), and Didelphidae (2). Families with a sole threatened species were

Dasyproctidae, Myrmecophagidae, Mustelidae, Cervidae, and Vespertilionidae (Table 1). Therefore, most carnivore species are actually threatened in Mato Grosso do Sul (e.g. *Panthera onca* and *Puma concolor*), as well as those species of large body size, such as *Myrmecophaga tridactyla*, *Pteronura brasiliensis*, *Blastocerus dichotomus*, and *Priodontes maximus*. We highlight the conserved condition of the Pantanal and adjacent areas in the west to safeguard these species, and the importance in creating conservation units in the state, particularly in the center, east, and south of the territory.

The Cerrado domain was richer (117 spp.) but quite similar to Pantanal (110) in richness, a pattern that must be related to the habitat heterogeneity and complexity of the last domain, despite of its higher stressing conditions and shorter geological history compared with Cerrado. Compared to natural areas of several other states along the Brazilian coast, the Pantanal and the adjacent Cerrado in Mato Grosso do Sul present increased environmental conservation and has served as refugia for mammals and other organisms as well (Mantovani and Pereira 1998; Rodrigues et al. 2002a). The number of bat species exclusively recorded in the Pantanal (12) was higher than those found only in Cerrado (8). This situation may be related to the bias of bat inventories towards the Pantanal, where a long-term program for bat collection has been carried out in the Federal University of Mato Grosso do Sul (E. Fischer, pers. obs.). This pattern is inverse for rodents which surveys were focused mainly in Cerrado (Bonvicino et al. 1996; Carmignotto 2004; Cáceres et al. 2007b). On the other hand, the transitional status of the Pantanal might allow colonization by species coming from different domains (Cerrado, Amazonia, Atlantic Forest, and Chaco).

Still in the Cerrado of Mato Grosso do Sul, the primate *Callithrix penicillata*, known as *mico-estrela*, is considered as an exotic species, being most probably transported from its original distributional region (Cerrado of central and northeastern Brazil) and released in the vicinities of Campo Grande. Indeed, its natural occurrence must be confirmed, since there are no museum or literature records for this species in the state.

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The influence of the Amazonian domain in the state of the Mato Grosso do Sul is clearly recognizable in the transitional forests of Urucum and Amolar (Veloso et al. 1992), which share species of that domain with the adjacent physiognomies, such as Chaco, Cerrado, and Pantanal (Myers 1989; Musser et al. 1998; Costa 2003; Cáceres et al. 2007d). Besides a total richness of 51 species, the number of 12 exclusive species to the transitional forests of Urucum and Amolar, mostly of rodents ($n = 6$), marsupials ($n = 2$), and primates ($n = 3$), is considerable and highlights the special biogeographic characteristic of that region. Indeed, the distributions of these species (e.g. the marsupial *Marmosops ocellatus*, the primates *Aotus azarae*, *Callicebus pallescens*, and *Callithrix melanura*, the southern Amazon Red Squirrel *Urosciurus spadiceus*, and the rodents *Akodon toba*, *Euryoryzomys nitidus*, and *Oecomys paricola*) are mostly linked historically to the Amazon domain or even to Chaco (Myers 1989; Emmons and Feer 1997; Musser et al. 1998; Eisenberg and Redford 1999; Cáceres et al. 2007d). This biogeographic pattern places the region of the western Mato Grosso do Sul, adjacent to the Paraguay River, as very complex (Vivo 1997; see also Myers 1982).

Atlantic Forest in Mato Grosso do Sul revealed only 37 species of mammals. This poor pattern may be related to two important factors that have happened in the south of the state. The first one is the general absence of mammal surveys in this region and the second one is related to the bad conservation status of all region, where only small fragments (usually less than 100 ha) of semideciduous forests have persisted. In fact, only two exclusive species were registered for the Atlantic domain, the rodents *Oecomys catherinae* and *Cavia fulgida*.

Based on the well known mammal fauna of the adjacent Paraguay (e.g. Myers 1982; Myers and Carleton 1981; Redford and Eisenberg 1992; Yahnke et al. 1998), several Atlantic Forest species are thought to be added to the Mato Grosso do Sul mammal list with intensive survey efforts in this southern region, mainly in the proximity of the Paraná River, where species dispersal is facilitated (Cáceres 2007).

A total of 90 species was shared between the main domains, Cerrado and Pantanal, probably those which are more generalist regarding habitat use, not restricting to forests, such as the marsupials *Didelphis albiventris* and *Monodelphis domestica*, the Yellow armadillo *Euphractus sexcinctus*, the rodent *Necromys lasiurus*, and several ($n = 41$) bat species (Mares et al. 1985; Yahnke 2006; Cáceres et al. 2007a; b). The rodent *Oecomys mamorae*, which also occurred in both domains, is in fact characteristic of open marshland habitats of the Pantanal and surroundings, and presents high ability to occupy marginal habitats (such as deciduous forests and cerrado *stricto sensu*) (Carmignotto 2004; Oliveira and Bonvicino 2006; N. C. Cáceres, pers. obs.).

Among non-flying mammals, 19 species, mostly of median and large size ($n = 13$), were widespread in all domains and transition. The Black Howler Monkey *Alouatta caraya* is adapted to seasonal dry forests, including savannas, allowing its occurrence in different habitats in its range in south-western Brazil (Bicca-Marques et al. 2006; Cáceres 2007; Cáceres et al. 2007a; 2008). Although the Anteater *Tamandua tetradactyla*, the carnivorous species *Eira barbara*, *Nasua nasua*, *Cerdocyon thous*, and *Puma concolor*, and the Tapir *Tapirus terrestris* are primarily forest dwellers (Cáceres et al. 2007a), they show generalist habit also occurring in secondary, shrubland, and more seasonal habitats (Emmons and Feer 1997; Johnson et al. 1999; Quadros and Cáceres 2001; Gatti et al. 2006; Cáceres et al. 2008).

The actual list of mammal species of the state of Mato Grosso do Sul in south-western Brazil is thought to be quite complete. The same is not true for species in specific domains, where there is absence of collections and studies of mammals, particularly for Atlantic Forest domain and Cerrado at east and south of the state. However Cerrado and Pantanal are indeed the richest domains in the state. Therefore, two main problems are thought to affect the knowledge of mammalian fauna in Mato Grosso do Sul: the failure of collections in certain regions and probable regional species extinctions that have occurred in the past due to human activity. However these are not quantified here.

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Looking specifically to the small mammal species, one problem related with the species richness is the real number of species recognized here or that we could distinguish based on morphology data. There are some cryptic rodent species (e.g. *Akodon*, *Calomys*, *Nectomys*, and *Rhipidomys*) that can only be distinguished based on karyotypic or molecular data; others, such as the marsupial genus *Cryptonanus* has never been

taxonomically revised in Brazil. These problems can encumber the knowledge of the exact number of species that are present in the state. More systematic studies and inventories, with testimony material and karyotypic and molecular information will reveal new records of species for the state, particularly in its border, where other mammals occur and were not recorded yet for Mato Grosso do Sul.

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